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Costs for Developed Recreation Sites in the Northern Region, USDA Forest Service

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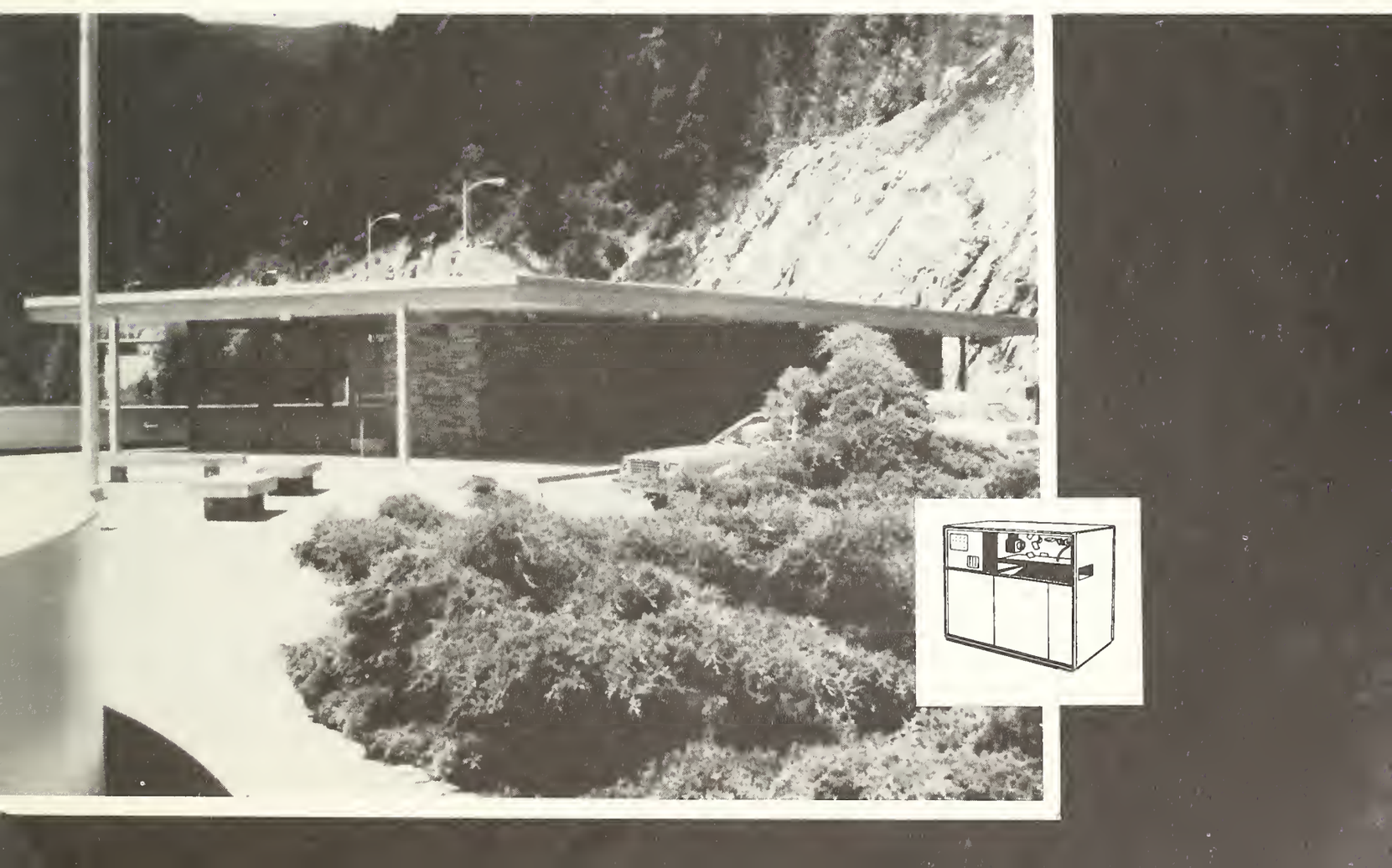

THE AUTHORS

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RESEARCH SUMMARY

Increasingly restrictive budgets, coupled with the information needs of quantitative forest planning models, compel managers to be more concerned with the costs of providing developed recreation opportunities in the Northern Region. The research being reported here studied 259 sites, almost half of those existing in 1980. Data were obtained from a variety of sources—personal interviews, facility inventory records, accounting records, and more. Estimates were made for planning costs, construction costs, and operation and maintenance costs. Costs that did not occur annually were annualized (amortized) at 4 and 7 percent real discount rates.

On an annualized basis (discounted at 4 percent), major interpretive sites are the most costly in the Northern Region, with an average annualized cost of about $360 per PAOT (**P**erson **A**t **O**ne **T**ime); annual costs for observation sites are least costly, averaging about $38 per PAOT. Annualized costs for other types of recreation sites are provided on the basis of the experience level for which they were designed. Information is presented to convert costs per PAOT to a site and recreation use level basis. For example, the annualized cost per major interpretive site is about $53,000. Finally, cost estimation equations are presented. Each permits estimation of total annualized costs per site as a function of PAOT capacity, and remoteness or fee payment where appropriate.

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INTRODUCTION

The decade of the 1970's reflected a substantial increase in demand for outdoor recreation. Overall recreation activity levels on National Forests in the Northern Region increased by about 25 percent. The nearly identical increase in developed outdoor recreation was met with an 18-percent increase in National Forest land allocated to developed recreation. Facilities such as campgrounds, picnic and boating sites (fig. 1), and interpretive facilities were constructed, operated, and maintained for public use.

Figure 1.—Excursion boat docking at Meriwether Campground, Holter Lake, Helena National Forest

The foreseeable future closely reflects the past. Agency budgets for recreation-related activities are not expected to increase sharply. Recent midlevel projections (USDA Forest Service 1980) of outdoor recreation demand to the year 2000 show an expected increase of 33 percent in developed camping over 1977, a 24-percent increase for picnicking, and a 34-percent increase for water-based outdoor recreation. The challenge is to do more, provide more, probably with less. Only an efficient operation can do this. Costs must be carefully weighed against benefits.

Pressures of high energy costs, restrictive budgets, and administrative accountability have caused managers to seek greater efficiency and cost effectiveness in resource usage. The 1974 Resources Planning Act requires identification of costs and benefits associated with Forest Service management actions. The National Forest Management Act of 1976 further reinforces the need to identify costs for land management planning. The information needs of quantitative forest planning models, such as FORPLAN, focus attention on costs. Yet very little information is available on costs.

The study being reported here was designed to provide recreation managers within the USDA Forest Service Northern Region with estimates of current costs for developed recreation sites and statistical models to predict costs in the future. Certain of these results can also contribute to management of dispersed recreation areas. This report is a substantial condensation of the study and its results. Readers interested in complete results and more detailed information are referred to a publication by Gibbs and Reed (1983).

METHODS

Developed recreation activities are those taking place at sites that have been "modified to enhance recreation opportunities," consistent with the natural resources present (USDA Forest Service 1982). The level of modification is related to the experience level (EL) expected for the recreationist:

Site modification	EL	User experience
Minimal modification	1	Primitive solitude
Little modification	2	Near primitive
Moderate modification	3	Essentially natural
Heavily modified	4	Not necessarily natural
Most modification	5	Social, group interaction

Clearly, there is a near-continuum between dispersed and developed recreation, with the latter characterizing the higher experience levels. Formal sites are commonly associated with developed recreation. The following types of recreation sites listed below were identified for study:

—Campgrounds
—Picnic grounds
—Boating sites
—Swimming sites
—Interpretive sites
—Observation sites
—Documentary sites

These types of sites, together with the EL classification, constitute the specific focuses for cost estimation.

Cost estimates for each type of recreation site were based on the total of planning costs and construction costs, together with operation and maintenance costs. Planning costs consist of labor expenses for time spent by personnel in design and layout activities, prior to facility construction. The result is an approved site development plan. Costs associated with site selection or review and approval of plans were not measured. Construction costs include purchase, installation, and construction of facilities—equipment, structures, etc.—at the site. Operation and maintenance costs are those annually recurring expenses needed to maintain a facility in operating order during a season, such as personnel, utilities, tools, and materials. Several costs were not assessed: administrative overhead, external (third-party) costs, and land opportunity costs.

We attempted to estimate costs of developed recreation sites for use in project evaluations and annual budgeting. Project evaluations frequently compare annual benefits to annual costs over the expected life of the project. But neither planning costs nor construction costs occur annually; at any site, they occur over a brief time period and then cease to exist. These costs were estimated and then converted (amortized) to an annualized equivalent by means of an installment payment formula. We used 4- and 7-percent real discount rates. Amortization periods varied, planning costs over 20 years and construction costs over 10 or 20 years on an item-by-item basis. Operation and maintenance costs were not amortized since they are already on an annual basis. For annual budgeting purposes, unannualized planning costs and construction costs are appropriate.

Because there are so many developed recreation sites in the Northern Region, estimates of cost parameters had to be developed by means of sample-based estimators. A sampling frame was developed, consisting of the 557 sites existing in 1980. Sampling frame of approximately one-third, one-half, or 100 percent resulted in the actual sample distribution shown in table 1. In total, 259 sites were evaluated, about 47 percent of the population. The sample was distributed over northern Idaho, western Montana, and eastern Montana.

A variety of information sources were used to estimate costs. Data on planning costs were obtained by interviewing personnel in the Northern Region. Construction cost estimates adopted the "current replacement value" convention (rather than original cost or some other convention). An inventory listing all facilities at each sampled site was obtained from RIM Facility Condition Records. Replacement cost estimates were generally obtained from RIM Special Report No. 31, although several alternative information sources were used as well. Almost all data used to measure operation and maintenance costs were obtained through interviews with recreation managers at sampled Ranger Districts. A questionnaire format was used. Supporting records (such as project work plans, vehicle use records, contracts, project managers' statements, and utility bills) were accessed during the interviews.

Table 1.—Study population and sample totals, by type of recreation site, Northern Region, 1980

Type of recreation site	EL[1]	Region total	Sites sampled
Family campground	2	72	40
	3	258	93
	4	14	14
Family picnic grounds	2	10	9
	3	63	30
	4	6	6
Boating sites	All	60	27
Swimming sites	All	19	9
Group campgrounds	All	3	3
Group picnic grounds	All	13	7
Interpretive sites, major	All	3	3
Interpretive sites, minor	All	17	9
Observation sites	All	10	6
Documentary sites	All	8	3
Information sites	All	1	0
Total		557	259

[1]Experience level.

RESULTS

Three types of study results will be presented. First, average costs for the various types of recreation will be discussed. The planning costs and construction costs are presented in both annualized and unannualized form. The annualized form of those costs, together with annual operation and maintenance costs, constitutes the estimate of average annual costs. Second, a set of multipliers is presented to convert average costs based on site capacity to either a site or output basis. Finally, a set of cost estimation equations is presented, each of which estimates average annual total costs per site on the basis of site capacity.

Average Costs

The information contained in table 2 provides an overall summary of the cost estimates developed in this study. All costs are expressed in terms of average costs per unit of site capacity. Capacity is measured by PAOT (Persons At One Time), a measurement unit common to all Forest Service developed recreation sites. PAOT represents the number of people who could simultaneously recreate at a site according to its design and facilities. Additionally, all dollars are expressed at the 1980 price level. The total average cost consists of the sum of the appropriate average cost components. For example, the total annual cost for EL 2 family campgrounds annualized at 4 percent is $130.33 per PAOT ($1.61 + $66.63 + $62.09).

The total of the average costs per PAOT varies widely. The least expensive facilities are observation sites and group campgrounds. The most costly facilities are

Table 2.—Average cost (dollars) per PAOT for developed recreation in the Northern Region, by type of recreation site, annualized and unannualized, 1980

Type of recreation site	EL[1]	Unannualized costs[2]		Annualized costs				Annual operation and maintenance[5]	Total		
				Planning[3]		Construction[4]			Annualized		
		Planning	Construction	4%	7%	4%	7%		4%	7%	Unannualized
Family campgrounds	2	21.88	824.21	1.61	2.07	66.63	83.87	62.09	130.33	147.53	908.18
	3	19.89	922.42	1.46	1.88	73.26	92.07	48.34	123.06	142.29	990.65
	4	18.20	1,101.17	1.34	1.72	86.69	109.19	40.51	128.54	151.42	1,159.88
Family picnic grounds	2	10.00	1,116.15	.74	.94	85.98	108.91	50.54	137.26	160.39	1,176.69
	3	14.49	773.05	1.07	1.37	61.86	77.59	41.17	104.10	120.13	828.71
	4	14.04	716.62	1.03	1.33	55.87	70.55	28.96	85.86	100.84	759.62
Boating sites	All	13.84	627.86	1.02	1.31	46.62	59.65	15.79	63.43	76.75	657.49
Swimming sites	All	16.42	549.23	1.21	1.55	41.82	53.14	19.85	62.88	74.54	585.50
Group campgrounds	All	16.36	244.01	1.20	1.54	18.64	23.67	20.24	40.08	45.45	280.61
Group picnic grounds	All	9.99	687.71	.73	.94	53.51	67.61	29.08	83.32	97.63	726.78
Interpretive sites, major	All	38.73	2,512.92	2.85	3.66	186.76	238.91	170.09	359.70	412.66	2,721.74
Interpretive sites, minor	All	6.81	1,986.24	.50	.64	148.06	189.24	16.46	165.02	206.34	2,009.51
Observation sites	All	5.96	299.31	.44	.56	23.40	29.52	13.96	37.80	44.04	319.23
Documentary sites	All	15.26	920.49	1.12	1.44	70.60	89.54	31.18	102.90	122.16	966.93

[1]Experience level.
[2]Unannualized costs are not the same as amortizing at a 0-percent discount rate.
[3]Amortized over 20-year project life.
[4]Individual facility items amortized over 10- or 20-year project life, depending on the item.
[5]Operation and maintenance costs are average annual costs.

interpretive sites, whether major or minor. But these extremes are represented by vastly different facilities. The larger PAOT capacity of group campgrounds tends to drive down average costs. And once established, observation sites are almost self-administering. On the other hand, interpretive sites are very labor-intensive facilities. In particular, major sites are typically highly developed, and usually include a separate building where environmental awareness and other educational programs are conducted.

Attention focused on cost extremes is somewhat misleading. Although the cost per PAOT may be high or low, there are very few extreme-cost facilities in the Northern Region. For example, there are only three facilities each in the group campground and major interpretive site categories. The bulk of the developed recreation sites are family campgrounds (EL 2 and 3) and family picnic grounds (EL 3). They constitute over 70 percent of the developed recreation sites. Tending toward the middle of the costs per PAOT, it would be correct to conclude that these three types of sites incur the bulk of the total costs.

It is difficult to reach unequivical conclusions about which type of cost is most significant—planning, construction, or operation and maintenance. The conclusion depends on both the type of recreation site and whether amortized or unamortized costs are assessed. But most evaluations would conclude that planning costs are relatively insignificant, being totally overwhelmed by the other costs. Comparisons between construction costs and operation and maintenance costs are less clear. Inspection of unamortized costs shows that construction costs exceed those for operation and maintenance by a factor as little as 12 for group campgrounds to as much as 121 for minor interpretive sites. When the comparison is made between annual operation and maintenance and annualized construction costs, the gap shrinks to as little as a factor of about 2. In fact, average operation and maintenance costs exceed construction costs for group campgrounds when the latter is annualized with a 4-percent real discount rate. The aforementioned vagueness notwithstanding, study results do support the overall conclusion that planning costs are least significant, followed by operation and maintenance costs, and finally the construction costs, with the latter being appreciably larger if not annualized.

Unlike the planning cost or the construction cost categories, operation and maintenance cost data were collected for specific subcategories. These are presented as percentage distributions in table 3 for the three most common types of developed recreation sites in the Northern Region. Labor costs clearly dominate operation and maintenance costs. Utility costs are inconsequential. Labor costs included permanent and temporary personnel as well as contributed personnel (YACC, CETA, Job Corps) and borrowed fire and timber crews. As shown, contributed and borrowed labor account for 12 to 18 percent of all operation and maintenance costs, about 25 percent of all labor costs. The percentage distribution pattern of operation and maintenance costs for other types of recreation is very similar to those shown in table 3.

Table 3.—Percentage distribution of operation and maintenance costs for the types of developed recreation facilities, by cost subcategories

Cost subcategory	Family campgrounds		EL 3, family picnic ground
	EL 2[1]	EL 3	
Labor	62	64	54
—contributed/borrowed	(18)	(17)	(12)
—Forest Service	(44)	(47)	(42)
Contract	15	16	24
Vehicles	14	12	13
Utilities	—	—	—
Tools and materials	9	8	9
Total	100	100	100

[1]EL = experience level.

Cost Estimate Conversions

Average costs can be expressed on bases other than PAOT. Two common, alternative bases are site and RVD. A site refers to the overall campground or picnic ground itself and not to a family unit or camping site within the campground. The Recreation Visitor Day (RVD) is an output measure, reflecting use by recreationists at a site. An RVD represents 12 visitor hours spent in any recreation activity; the hours may be aggregated continuously, intermittently, or simultaneously, by one or more persons. Table 4 is provided to the reader desiring cost estimates in terms of dollars per site or RVD. It consists of a set of multiplication factors, and is to be used in conjunction with table 2. For example, assume the need to estimate average annual cost per RVD, amortized at 4 percent, for EL 2 family campgrounds. Simply locate the appropriate cost per PAOT in table 2 ($130.33) and the conversion factor in table 4 (0.01265). Multiplying the cost per PAOT by the factor results in a cost in 1980 dollars per RVD of $1.65 ($130.33 X 0.01265). Similarly the annual average cost per site is $3,063 ($130.33 X 23.50).

Cost Prediction Models

Finally, this study attempted to develop models to predict the annual total costs (AnTC) of the several recreation activities studied. Results of this effort are shown in the equations of table 5, which explain the variation in AnTC on the basis of site capacity and other site-specific variables. The models shown are the final models, not the initial ones. Some initial models contained additional independent variables: G—geographic zone and L—length of season. But in the model-form selected, only those variables shown in table 5 were statistically significant at the $\alpha = 0.05$ level. The intermediate models treated types of recreation sites and experience level as dummy variables and contained interaction terms; they were judged too cumbersome for general presentation. The final models shown in table 5 are a condensation of the intermediate models. Annual total costs consist of annual operation and maintenance costs together with planning costs and facilities costs annualized with a 4-percent discount rate. Final models contain three independent variables—site capacity (PAOT), remoteness (R), and fee structure (F). The fee variable refers to charges to users of a site. The variable is code "1" if fees are charged, "0" if not.

Cost prediction models can be used directly to estimate annual total costs. Information needed includes specification of PAOT site capacity, the remoteness variable R—distance in miles to the nearest Federal highway or interstate freeway, and, in some cases, existence of user fees. Specified PAOT levels and remoteness distances should be within the data range shown. For example, an estimate of the annual total cost of an EL 3 family picnic ground with a PAOT capacity of 100 located 10 miles (16.1 km) from the nearest Federal highway would be:

$$\begin{aligned} \text{AnTC} &= \$2{,}550 + \$35.27(100) + \$70(10) \\ &= \$2{,}550 + \$3{,}527 + \$700 \\ &= \$5{,}777 \end{aligned}$$

If the user wants to estimate AnTC for some hypothetical campground of unknown remoteness, the mean distance (R) for sample data of 20.6 miles (33.2 km) could be used.

Table 4.—Conversion factors to $/site and $/RVD from $/PAOT, by type of recreation site, Northern Region, 1980

Type of recreation site	EL[1]	Multiplication conversion factors	
		$/site	$/RVD (1980)
Family campgrounds	2	23.50	0.01265
	3	89.09	.01401
	4	169.33	.01448
Family picnic grounds	2	20.56	.01869
	3	54.47	.03447
	4	98.33	.02161
Boating sites	All	88.78	.04809
Swimming sites	All	78.33	.03653
Group campgrounds	All	150.00	.04736
Group picnic grounds	All	59.29	.04224
Interpretive sites, major	All	147.50	.01766
Interpretive sites, minor	All	102.14	.00887
Observation sites	All	70.83	.03455
Documentary sites	All	23.33	.02187

[1]Experience level.

Table 5.—Annual total cost (AnTC) per site for developed recreation site in the Northern Region, by type of recreation site, 1980[1]

Type of recreation site	EL[2]	Cost prediction model	PAOT range[3]	
			Min.	Max.
Family campgrounds[4]	2	$AnTC = -2152 + 113(PAOT) - 0.073(PAOT)^2 + 3536(F) + 90.5(R)$	10	85
	3	$AnTC = -975 + 113(PAOT) - 0.073(PAOT)^2 + 3536(F) + 90.5(R)$	15	430
	4	$AnTC = 721 + 113(PAOT) - 0.073(PAOT)^2 + 3536(F) + 90.5(R)$	15	345
Family picnic grounds[5]	2	$AnTC = 335 + 35.27(PAOT) + 70(R)$	15	25
	3	$AnTC = 2550 + 35.27(PAOT) + 70(R)$	25	136
	4	$AnTC = 4941 + 35.27(PAOT) + 70(R)$	30	160
Boating sites	All	$AnTC = -1162 + 55.67(PAOT) + 70.13(R)$	20	250
Swimming sites	All	$AnTC = -1162 + 57.06(PAOT) + 70.13(R)$	20	200
Group picnic grounds	All	$AnTC = -1162 + 94.77(PAOT) + 70.13(R)$	32	490
Interpretive sites,[6] major	All	$AnTC = 30479 + 161.47(PAOT)$	120	175
Interpretive sites, other	All	$AnTC = -2187 + 161.47(PAOT)$	10	415

[1]Annual total costs consist of annual operation and maintenance costs, with planning costs and construction costs amortized at 4 percent.
[2]Experience level.
[3]The range for the remoteness variable (R) was 0 to 74 miles.
[4]The general model estimating campgrounds had an $R^2 = 0.78$.
[5]The general model estimating picnic grounds, boating sites, and swimming sites had an $R^2 = 0.74$.
[6]The general model estimating interpretive sites had an $R^2 = 0.83$.

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MANAGEMENT APPLICATION

The cost information presented in this report has a variety of potential applications. The most obvious application involves the need for unit cost estimates in forest planning models, such as FORPLAN. Cost data contained in table 2, modified as needed by the conversion factors in table 4, are well suited to that use. The cost equations shown in table 5 lend themselves to economic efficiency analysis. Specifically, those equations can be used to identify the optimal capacity of recreation sites, be they campgrounds, picnic grounds, and the like. Finally, these data can prove useful when analyzing user fees or user benefits. In the case of fees, comparisons can be made between costs and revenues generated by fees with the possible outcome being fee structure modification. Where fee charges are not at issue, estimated costs can be compared to perceived user benefits in a subjective benefit-cost analysis.

Results presented have limitations. One limitation with this and similar studies is the accuracy of raw data. Data collection efforts were carefully planned, used best techniques available, and extended over several months. Nevertheless, data came from several sources, with varying degrees of accuracy. Data based on personal recall are always troublesome, although of minor importance on balance. Similarly, conversion factors for RVD-based cost estimates should be used with caution since the underlying RVD data are of unknown quality. Another limitation is that not all costs were measured. In particular, the absence of administrative overhead costs should be noted. These indirect costs are present but very difficult to measure and evaluate. Cost estimates presented necessarily understate the actual magnitude of costs.

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Costs of various categories of campgrounds and picnic grounds, together with boating, swimming, and interpretive sites, are presented. Cost estimates are classified as to planning costs, construction costs, and operation and maintenance costs, all amortized and unamortized. Conversion factors are presented to express costs on the basis of site, site capacity, and recreation use levels. Statistical cost models are developed to predict annual total cost per site as a function of site capacity and other variables. Data were obtained for a sample of sites and converted to 1980 dollars.

KEYWORDS: costs, developed recreation, recreation management